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Langley Research Center



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Lightweight Orthotic Braces

The lightweight leg brace shown in the illustration is constructed of fiber-reinforced polymer material. This composite material (composed of fibers held together in a plastic matrix) is stiffer, stronger, and lighter than most metals.

Conventional orthotic braces are constructed of steel, aluminum, leather, wood blocks, and some form of padding. The weight of braces constructed of these materials impairs the movement of people wearing the support. An effort to reduce the weight and cost of a leg brace has resulted in the replacement of the conventional strut members and the thigh and calf bands with ones made of graphite-reinforced epoxy composite material. The composite components are stronger and weigh less than half what their metal counterparts weigh. The composite members are fabricated by placing layers of the graphite-epoxy composite prepreg material in molds and then heating the assembly in an oven for curing.

A composite material which can be adjusted to patient growth or leg size is necessary for the material to be more generally applicable to brace construction. Brace components of graphite/polysulfone thermoplastic composite material can be fabricated with simple forming techniques. After initial shaping, graphite/polysulfone bars can be reshaped by the application of heat and pressure. This material can be cut, filed, drilled, or sawed like metals.

Other materials and technologies are being investigated for improving the characteristics of other brace components:

- a. The feasibility of injection molding chopped carbon-fiber-reinforced nylon into a strong lightweight knee joint has been successfully demonstrated, which indicates the possibility of rapid production of such joints at greatly reduced cost.



Lightweight Orthotic Leg Brace

(continued overleaf)

- b. A lightweight composite material metal honey-comb shoe extension has been successfully fabricated which can replace wooden block shoe fillers.
- c. The padding and leather straps of leg braces can probably be replaced with a nylon mesh, which will further reduce overall brace weight with no strength reduction.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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Categories: 05 (Life Sciences)
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